

ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 7]

[1923

XXI.—CONTRIBUTIONS TOWARDS A PHYLOGENETIC CLASSIFICATION OF FLOWERING PLANTS. II.*

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THE GENERA OF ANONACEAE.

In common with many other natural families of flowering plants, such as *Cruciferae*, *Umbelliferae*, *Papilionaceae*, etc., the family *Anonaceae* contains a certain number of purely artificial genera separated on very slender characters, so that theories based on their probable phylogeny and phytogeographical distribution should be deduced with considerable caution. And in such families there is much scope for the individual botanist to exercise his own particular views as to the best definition and disposition of the groups and genera. During the last hundred years the family *Anonaceae* has received the attention of many systematists, prominent amongst them being Baillon†, King‡ and Engler & Diels§ whilst R. E. Fries and W. E. Safford have independently done some admirable work on certain Tropical American groups, and a revised key to the African genera has also recently been published||. In spite of the considerable amount of taxonomic work on the family, however, no classification has as yet very satisfactorily resolved the genera into tribes, and several of the genera remain rather ill-defined. The present account should therefore be regarded as tentative. A future monographer would probably find it necessary to reduce considerably the number of genera, of which there are no less than ninety-five in the present enumeration. In the past, perhaps too much stress has been laid on the shape and size of the anther

* Continued from *K. B.*, 1923, p. 89.

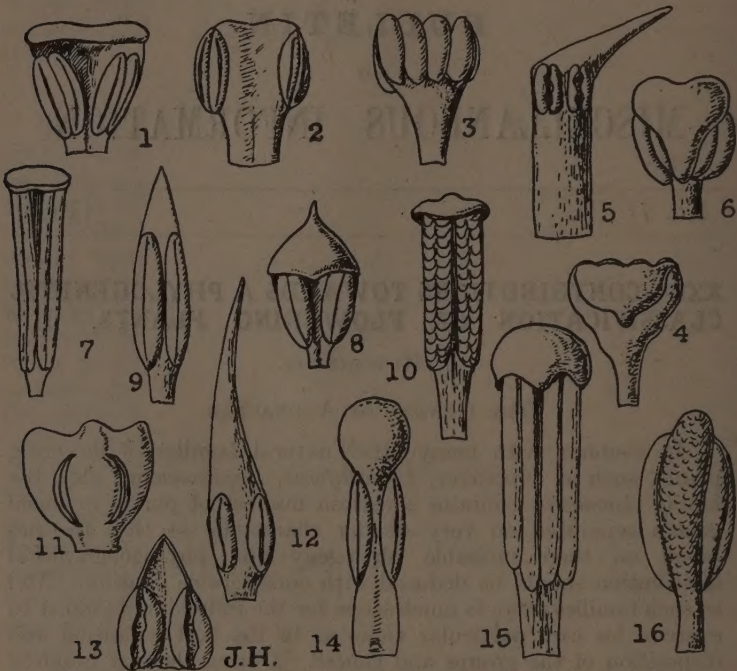
† Baillon, "Mémoire sur la fam. des Anonac.," *Adansonia* 8: 162-184 295-344 (1867).

‡ King, "The Anonaceae of British India," *Ann. Bot. Gard. Calcutta*, 4: 1-169, pl. 1-220 (1893).

§ Engler & Diels, *Monogr. Afr. Anonac.* 1-96, pl. 1-xxx (1901).

|| Sprague & Hutchinson in *Kew Bull.* 1916, 145.

connective (see text figure), for tribal distinctions at any rate, this character being used very prominently by Bentham & Hooker.



Types of stamens in ANONACEAE: 1. *Desmos Stuhlmanni*. 2. *Popowia congensis*. 3, 4. *Popowia Schweinfurthii*. 5. *Popowia fornicata*. 6. *Orophea Thorelii*. 7. *Anonidium Mannii*. 8. *Polyalthia Oliveri*. 9. *Artabotrys Harmandii*. 10. *Xylopia africana*. 11. *Popowia Barteri*. 12. *Sageraea Hookeri*. 13. *Popowia fornicata*. 14. *Oxandra laurifolia*. 15. *Desmos Mesnyi*. 16. *Asimina triloba*.

In the present revision, the *Monodoroideae* are regarded as sufficiently distinct to be classed as a subfamily, on account of their carpels being united into a one-celled ovary, with parietal placentation, which is a great advance on the general structure of the gynaeceum, and on account of their gamopetalous corolla. The remainder of the family is divided into three tribes, the first, *Uvarieae*, showing the most primitive features in that either one or both rows of petals are imbricate, and the anther-connective almost invariably truncate and hiding the thecae, reminding one very much of those of *Cycadaceae* and some *Pinaceae*. It is suggested that this type of anther shows relationship, very remote though it may be, with these more ancient groups.

The second tribe, *Miliuseae*, is distinguished by its valvate petals, but more especially by the outer petals being shorter than the inner, and often scarcely different from the sepals, resembling them in shape, texture, and possibly also in colour.

The third and by far the largest tribe is the *Unoneae*, in which the petals are also valvate, but they are equal or subequal in size or the inner may be much modified and smaller than the outer, sometimes being connivent and closely adpressed over the genitalia. I have had to be content with arranging the genera of this tribe into two subtribes, *Xylopineae* and *Anonineae* determined by the apocarpous and falsely syncarpous gynaecia respectively. Then the *Xylopineae* resolve themselves into three series, the *Hexapetalae*, *Tetrapetalae* and *Tripetalae*, according to the reduction in the number of the petals as indicated by their names. This arrangement, though undoubtedly rather artificial, reflects the comparatively rare tendency to reduction in the family, and will perhaps facilitate determination.

No doubt the bad state of dried specimens has contributed much to the unsatisfactory classification of this family, explained by the fact that they are found mostly in dense moist tropical forests, wherein the collection of herbarium material presents more than ordinary difficulty, for the flowers, being mostly fleshy, shrivel when dry and become very brittle.

Since the family was first monographed by Dunal in 1817, our knowledge has increased greatly through further exploration of the tropics. At that date only 103 species were known to botanists and most of these very imperfectly. In 1832, A. de Candolle's review brought to light 204 species, whilst Bentham & Hooker's estimate in 1862 was 400 species disposed through 40 genera. The present work accounts for 95 genera and a moderate estimate of something like 1150 species.* The botanical exploration of Tropical Africa has brought to light a considerable number of new genera, especially the forest area from Nigeria to the Congo, and particularly the Cameroons, where many small endemic and peculiar types have been discovered.

GEOGRAPHICAL DISTRIBUTION OF ANONACEAE.

Anonaceae are almost wholly confined to the Tropics, where they generally grow at low elevations. For example they are very abundant in the rain-forest area of Western Africa, but nearly unrepresented in the adjacent and more elevated savannah regions. In Ceylon they do not ascend the mountains higher than 2000 metres, and in the Khasia Hills of Assam not beyond about 1600 metres. In Brazil their greatest elevation is probably about 1300 metres. The only genus extending for any distance into the temperate zone is *Asimina*, which occurs in Eastern America as far north as the Great Lakes.

There is a marked contrast in the habit of the species of the two hemispheres. In the tropics of the Old World they are usually of climbing or straggling habit, and occur in dense forest areas; but in Tropical America they are nearly all shrubby or arboreal and mostly grow on the campos or open grassy plains.

* The genus *Eupomatia* R. Br. is considered to be a distinct family and is not included.

Examples of intercontinental distribution or affinity are not numerous, but they are of considerable interest. The only large natural genus common to the tropics of both hemispheres is *Xylopia* (see map), which is remarkable in the family in having transversely septate anthers. The small Brazilian genera *Cardiopetalum* and *Hornschuchia* also show this character. A new species of *Xylopia* recently discovered in the Cameroons (*X. hypolampra*) described by Dr. Mildbraed shows close affinity with certain Brazilian species. But the most remarkable instance of disconnected distribution in the case of a very natural and outstanding genus is *Anaxagorea*, which is common to Central and North Western South America and Indo-Malaya (see map). Besides the genus *Xylopia* there are two other notable examples of affinity between Africa and Indo-Malaya, namely, the relatively primitive and extensive genus *Uvaria* (see map) and the genus *Artabotrys* with its peculiar hooked inflorescences. Two other genera, *Popowia* and *Polyalthia*, are also common to these two regions, but with less significance from a geographical point of view, for neither could be described as a natural genus, as it has evidently been a receptacle for species not easily otherwise classified. In the Indo-Malayan region, *Sageraea* conforms exactly with Wallace's western area, whilst *Phaeanthus* is common to both parts.

KEY TO THE GROUPS OF ANONACEAE.

Subfamily I. **ANONOIDEAE.** Carpels free or if united forming a many-celled syncarp; stigmas erect.

Petals always in two series, both or only the inner series imbricate; indumentum of the leaves usually stellate or lepidote

Tribe I. **UVARIEAE.**

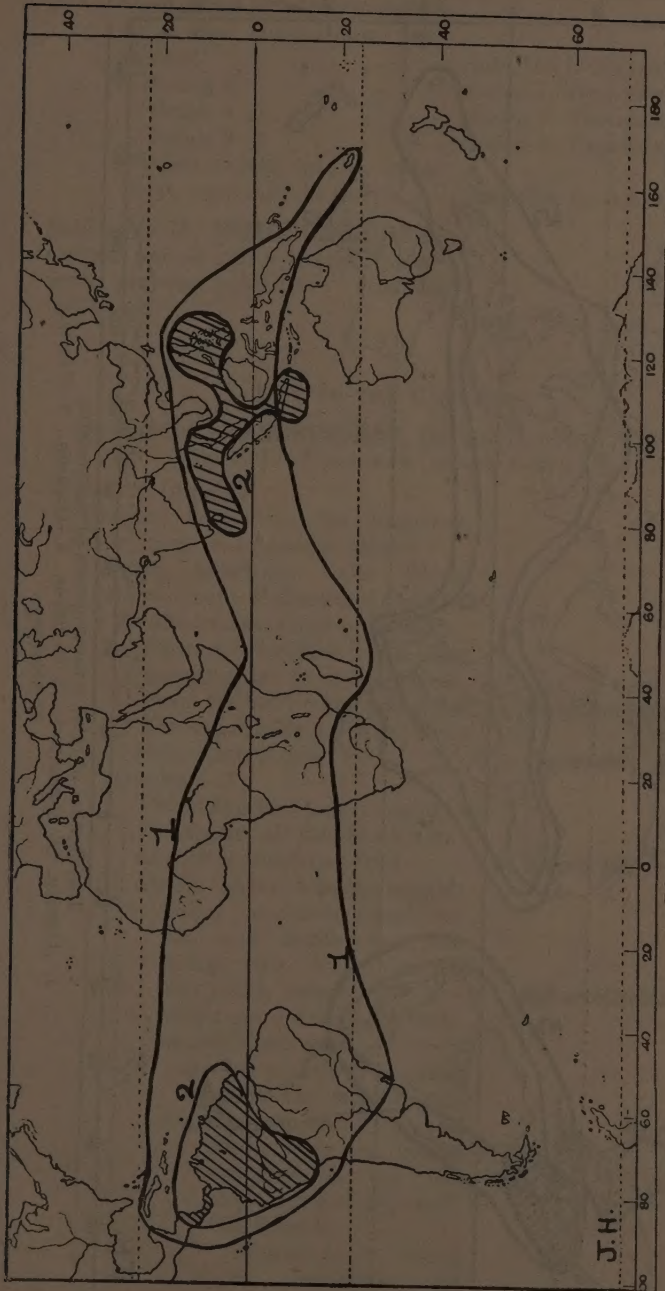
Petals all valvate, either in two distinct series or rarely in one series, usually 6, rarely 4, more rarely 3, in the latter case either the inner or the outer series missing :—

Outer three petals smaller than the inner ones and often scarcely distinguishable from the sepals

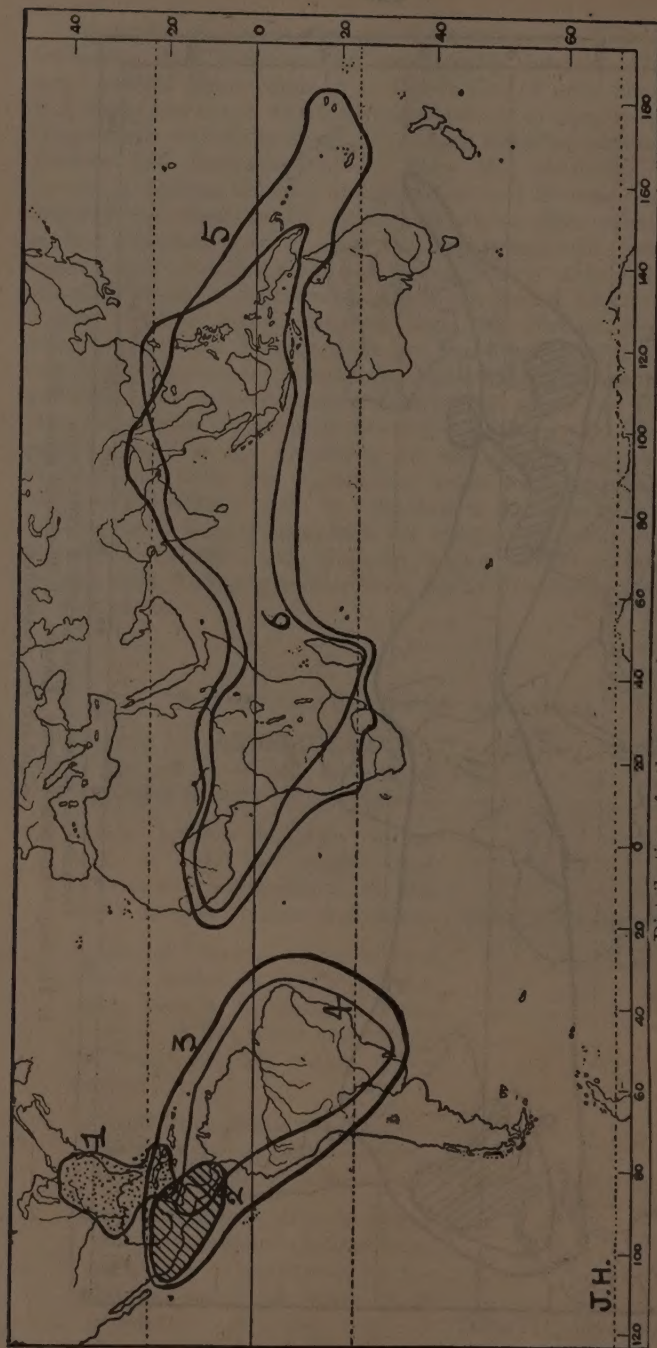
Tribe II. **MILIUSEAE.**

Outer petals as large or larger than the inner and distinct from the sepals or sometimes by reduction only one series of 3 present - - - - -

Tribe III. **UNONEAE.**



Distribution of two natural genera of ANONACEAE.
 1. The only cosmopolitan genus, *Xylopiia*. 2. The small genus of closely allied species, *Anaxagorea*.



Distribution of other natural genera of ANONACEAE.
 1. *Asimina*. 2. *Sapranthus*. 3. *Guatteria*. 4. *Duguetia*. 5. *Uvaria*.
 6. *Artabotrys*.

Carpels not united or if slightly so then always quite free in fruit - - - -

Subtribe i. XYLOPINEAE.

Petals 6 - - - -

Series 1. *Hexapetalae*.

Petals 4 - - - -

Series 2. *Tetrapetalae*.

Petals 3 - - - -

Series 3. *Tripetalae*.

Carpels united into a fleshy mass, especially in fruit -

Subtribe ii. ANONINEAE.

Subfamily II. **MONODOROIDEAE.**

Carpels united into a 1-celled ovary with parietal placentas; stigmas radiating.

KEY TO THE GENERA.

Subfamily I. **ANONOIDEAE** (to genus 93, p. 225).

Tribe I. **UVARIEAE** (genera 1-27).

*Petals 6; sepals 3:

†Flowers borne on the branches, never from underground shoots:

‡Calyx imbricate; Old World genera except *Malmea* and *Oxandra*:

Ovules numerous (6 or more):

Flowers in fascicles on the older wood remote from the leaves;

torus conical or hemispherical.

1. **Stelechocarpus.**

Flowers usually axillary; torus flat; carpels few - - -

2. **Sageraea.**

Ovules 1-2:

Petals shorter than or equal to the sepals, all striate-nervose;

anther-connective pilose -

3. **Marcuccia.**

Petals longer than the sepals:

Calyx becoming membranous and much enlarged,

hiding the fruit; sepals

and petals striate - -

4. **Sphaerotheralamus.**

Calyx not enlarging in fruit,

mostly deciduous:

Anther-connective truncate at the apex; stamens numerous:

Flowers on the young

branches or on the

stem, not leaf-opposed;

Old World:

Flowers on the young

or one-year old

branchlets; petals

- not gibbous in the middle - - - 5. **Griffithianthus**.
 Flowers on the main stem or branches ; petals gibbous in the middle - - - 6. **Enicosanthum**.
 Flowers in a leaf-opposed inflorescence ; Trop. Amer. - - - 7. **Malmea**.
 Anther-connective lanceolate ; stamens 10-15 ; Trop. Amer. - - - 8. **Oxandra**.
- ††Calyx valvate :
 §Carpels free from each other, at least in fruit :
 ||Ovules numerous (6 or more) :
 Petals not united at the base :
 Trop. Amer. genera :
 Flowers small, about 1 in. long ; petals not striate ; Peru - - - 9. **Porcelia**.
 Flowers large, over 3 in. long ; petals conspicuously striate ; Cent. Amer. - - - 10. **Sapranthus**.
 Old World genera :
 All the petals remaining incurved ; flowers small 11. **Cyathostemma**.
 Inner petals without glands at the base, at length spreading - - - 12. **Uvaria**.
 Inner petals with two basal glands, remaining erect - - - 13. **Anomianthus**.
 Petals connate at the base into a distinct tube :
 Anthers not transversely locellate ; East Africa - 14. **Asteranthe**.
 Anthers transverselylocellate ; Brazil - - - 15. **Cardiopetalum**.
- ||||Ovules 1-3 :
 Ovule inserted above the middle of the carpel ; Malaya 16. **Ellipeia**.
 Ovules inserted near the base of the carpel :
 Carpels more than 1 :
 Flowers bisexual :
 Outer petals much longer than inner and

spreading, the inner
closely adpressed over
the stamens and car-
pels; ovules 1-2;
seeds tuberculate ;

Trop. Afr. - - - 17. *Cleistopholis*.

Outer petals about
equal to the inner
in length, all open in
flower; ovule 1 :

Carpels sessile or
nearly so in fruit :

Carpels numer-
ous, beaked,
crowded, with
several flattened
sides ; Trop.

Amer. - - - 18. *Duguetia*.

Carpels few, not
beaked, loose,
rounded; Mal.

Penins - - - 19. *Uvariella*.

Carpels more or
less stipitate in
fruit; Trop. Amer.

(see also *Popowia*) 20. *Guatteria*.

Flowers unisexual,
dioecious (?) Brazil -

21. *Ephedranthus*.

Carpel 1; flowers fascicu-
late on the older branch-
lets; stamens about 12;
stigma sessile, peltate;

Mal. Penins. - - - 22. *Kingstonia*.

§§ Carpels united, especially in
fruit :

All the stamens fertile; Trop.
Afr. :

Ovules numerous; indu-
mentum stellate - - - 23. *Pachypodanthium*.

Ovule 1; indumentum not
stellate - - - - - 24. *Anonidium*.

Outer stamens not fertile, with
petaloid appendages; Trop.

Amer. - - - - - 25. *Fusaea*.

†† Flowers borne on sucker-like un-
derground shoots; indumentum stel-
late-lepidote; anther-connective not
swollen above the cells; carpels
closely crowded; Trop. Amer. -

26. *Geanthemum*.

**Petals 4; sepals 2; climber; Borneo - 27. *Tetrapetalum*.

Tribe II.—MILIUSEAE (gen. 28-37).

Anther-connective widened and truncate at the apex :

Margins of inner petals not or only slightly inrolled, petals hardly boat-shaped :

*Flowers solitary or subsolitary :

Inner petals not clawed :

Inner petals thick and concave at the base; pedicels short :

Inner petals more or less triangular in section in the upper part; Trop. Amer. -

28. *Heteropetalum*.

Inner petals subterete and acuminate in the upper part; Trop. Asia -

29. *Marsypopetalum*.

Inner petals flat and rather thin; Trop. Asia -

30. *Phaeanthus*.

Inner petals clawed; Java -

31. *Trivalvaria*.

**Flowers in fascicles with simple pedicels; Trop. Afr. -

32. *Brieya*.

***Flowers paniculate; styles united; Trop. W. Afr. -

33. *Piptostigma*.

Margins of the inner petals much inrolled, the inner petals thick and boat-shaped; flowers solitary, extra-axillary on slender stalks; Trop. Amer. -

34. *Cymbopetalum*.

Anther-connective not truncate, more or less pointed :

Inner petals broad, thick and concave at the base :

Flowers in rather dense clusters of small cymes -

35. *Mezzettiopsis*.

Flowers usually solitary on simple long slender pedicels -

36. *Saccopetalum*.

Inner petals flat and thin, broad at the base -

37. *Miliusa*.

Inner petals clawed at the base and more or less connivent at the apex

79. *Orophea*.

Tribe III.—UNONEAE (gen. 38-93).

Subtribe I.—XYLOPINEAE (genera 38-89).

Series 1.—*Hexapetalae* (genera 38-79).

*Connective truncate or broadly triangular and more or less hiding the anther-cells :

†Ovules numerous (at least more than 2) :

‡ Petals of the two series similar and approximately of equal size, usually free from each other - - -

§ Anthers not transversely septate :

Petals not united at the base, at most slightly connivent :

Indumentum stellate or lepidote :

Flowers on the young shoots, solitary :

Indumentum lepidote ;

Trop. Afr. - - -

38. **Meicarpidium.**

Indumentum stellate ;

Malaya :

Carpels several - -

39. **Rauwenhoffia.**

Carpel solitary - -

40. **Monocarpia.**

Flowers several together on the old wood ; petals sharply contracted at the base over the stamens and carpels ; Malaya, New Guinea - - -

41. **Drepananthus.**

Indumentum, when present, of simple hairs :

New World genera :

Flowers leaf-opposed or terminal - - -

42. **Desmopsis.**

Flowers axillary ; petals short, broadly ovate -

43. **Trigyneia.**

Old World genera :

Fruit slender, very torulose or reduced to one seed - - -

44. **Desmos.**

Fruits thick, not torulose ; petals more or less spreading in the upper part :

Petals pointed, triangular - lanceolate, gradually narrowed from a broader base upwards and divergent ; pedicel bracteate - - -

45. **Meiogyne.**

Petals linear to obovate, spreading from above the broadened concave base which

- remains closely ad-
pressed against the
stamens - - - 46. **Cyathocalyx.**
- Petals shortly tri-
angular-lanceolate or
ovate often very
thick, with flattened
sides :
Carpels 2-3, not
constricted between
the seeds; New
Guinea - - - 47. **Oncodostigma.**
- Carpels 3-4, not
known in fruit;
stigma pileate-
capitate; Trop.
West Afr. - - - 48. **Alphonseopsis.**
- Carpels about 12,
slightly constricted
between the seeds;
Philipp. Isl. - - - 49. **Guamia.**
- Petals united into a tube at
the base :
Petals transversely plicate
in bud; Trop. Afr., Madag. 50. **Hexalobus.**
- Petals not plicate in bud;
New Guinea - - - 51. **Papualthia.**
- §§Anthers transversely septate (see
also *Cardiopetalum* in Tribe
Uvarieae) - - - 52. **Xylopia.**
- §§§Anthers not known; closely
allied to preceding - - - 53. **Polyceratocarpus.**
- ††Petals of the two series very dis-
similar and usually very unequal
in length, free from each other :
Carpels not sunk in the torus :
Trop. Asia :
Petals shortly united at the
base; New Guinea - - - 51. **Papualthia.**
- Petals not united :
Inner petals not clawed - 54. **Melodorum.**
- Inner petals clawed - - - 55. **Mitrephora.**
- Trop. Afr.; Inner petals not
clawed - - - 56. **Uvariastrum.**
- North and Cent. Amer. - - - 57. **Asimina.**
- Carpels sunk in the torus; Mascar. 58. **Pseudanona.**
- †††Petals in a single series :
Carpels about 24, some of the
stamens sterile; Trop. Afr. - - - 59. **Monanthotaxis.**

- Carpels 6; stamens all fertile;
 N. Austral. - - - - 60. *Haplostichanthus*.
- ††Ovules 1-2:
 Peduncles becoming indurated and thickened, hook-like; petals with a dorsal horn-like appendage;
 Trop. Old World - - - - 61. *Artabotrys*.
 Peduncles not hooked:
 Carpels more than 1:
 Seeds neither triquetrous nor winged:
 Petals subequal in length:
 Trop. Amer.:
 Petals not winged on the back - - - - 62. *Unonopsis*.
 Petals broadly winged on the back - - - - 63. *Rolliniopsis*.
 Trop. Old World:
 Style nearly as long as ovary, more or less slender and terete; New Guinea:
 Carpels numerous - - 64. *Schefferomitra*.
 Carpels 3-6 - - - - 65. *Oreomitra*.
 Style very short or almost absent:
 All the petals more or less opening out in flower - - - - 66. *Polyalthia*.
 Inner petals remaining more or less incurved over the stamens and carpels and often somewhat connivent - - - - 67. *Popowia*.
 Petals very unequal:
 Petals united at the base 51. *Papualthia*.
 Petals free or slightly connivent:
 Petals with a contracted concave base; flowers extra-axillary;
 West Trop. Afr. - - - - 68. *Stenanthera*.
 Petals not concave at the base:
 Inner petals not clawed - - - - 69. *Oxymitra*.
 Inner petals clawed - 70. *Goniothalamus*.
 Seeds triquetrous, winged, Fiji 71. *Richella*.
 Carpel 1; Malaya - - - - 72. *Mezzettia*.

**Connective lanceolate or not produced above the cells :

Carpels dehiscent; seeds black and shining - - - - - 73. *Anaxagorea*.

Carpels indehiscent :

Petals subequal :

Trop. Amer. :

Flowers on the young shoots; buds depressed-globose; carpels subglobose - - - 74. *Bocagea*.

Flowers on old leafless branches; buds oblong-linear; anthers multilocellate; carpels linear - - - - - 75. *Hornschuchia*.

Trop. Asia :

Connective of the stamens small and not conspicuous; petals more or less triangular and short - - - - - 76. *Alphonsea*.

Connective of stamens very sharply pointed; petals strap-shaped, long - - - - - 77. *Canangium*.

Petals very unequal :

Inner petals not longer than the outer, not clawed - - - 78. *Platymitra*.

Inner petals longer than the outer, clawed - - - - - 79. *Orophea*.

Series 2. *Tetrapetalae*.

Carpels more than 1 :

Flowers hermaphrodite; petals linear; anther-connective rounded-truncate; Malaya - - - - - 80. *Disepalum*.

Flowers dioecious; petals ovate, free, thick; connective of stamens not produced; carpels hexagonal; Trop. Afr. - - - - - 81. *Tetrastemma*.

Flowers monoecious (?); petals ovate, connate into a tube; carpels terete; Trop. Afr. - - - - - 82. *Uvariopsis*.

Carpel 1; Mexico - - - - - 83. *Tridimeris*.

Series 3. *Tripetalae*.

Ovules 2 or more :

Anther-connective truncate at the apex; flowers hermaphrodite :

Petals linear-lanceolate; Trop.

Asia - - - - - 84. *Dasymachalon*.

Petals ovate or suborbicular :

Petals large, subreniform, 3.5 cm. long; Trop. Asia - - - 85. *Petalolophus*.

Petals small, ovate-orbicular,
about 1 cm. long; Trop. Asia - 86. *Dennettia*.
Anther-connective not produced at
the apex; cauliflorous; dioecious, on
very long pedicels; Trop. Afr. - 87. *Thonnera*.

Ovule 1:

Petals opposite the sepals; Trop. Afr. 88. *Enantia*.
Petals alternate with the sepals;
Borneo - - - - - 89. *Eburopetalum*.

Subtribe II. ANONINEAE.

Petals subequal; ovules numerous;
Java - - - - - 90. *Ararocarpus*.

Petals unequal; ovule 1:

Petals free:

Connective produced beyond the
anther-cells; flowers monoecious - 91. *Anona*.

Connective not produced beyond
the anther-cells; S. Amer. - - - 92. *Raimondia*.

Petals connate at the base, the outer
enlarged into a thick spreading ap-
pendage - - - - - 93. *Rollinia*.

Subfamily II. MONODOROIDEAE,

Trop. Afr., Madagascar.

Petals all alike; corolla small - - - 94. *Isolona*.

Inner and outer petals very dissimilar,
the latter larger with wavy margins - 95. *Monodora*.

Subfamily I.—ANONOIDEAE.

Tribe I.—UVARIEAE.

1. *Stelechocarpus* Hk. f. & Thoms.—5 spp. S.E. Ind. to Java;
type sp. *S. Burahol*, Chittagong & Java.—King, Ann.
Bot. Gard. Calcutta 4: 3.
2. *Sageraea* Dalz.—7 spp. Ind. Penins., Ceylon, Burma to Mal.
Archip.; type sp. *S. laurina*, Bombay.—King, Ann. Bot.
Gard. Calcutta 4: 5.
3. *Marcuccia* Becc. in Nuov. Giorn. Bot. Ital. 3: 181, t. 3 (1871).
—1 sp., *M. grandiflora*, Borneo.
4. *Sphaerotheralamus* Hk. f.—1 sp., *S. insignis*, Borneo.—Becc.
Nuov. Giorn. Bot. Ital. 3: 189, t. 7.
5. *Griffithianthus* Merr. (*) in Philipp. Journ. Sci. Bot. 10: 231,
1915; (*Griffithia*, Maing. ex King (1893), not Wight & Arn.,
1834).—4 spp. Mal. Penins., Philipp. Isl.; type sp. *G.*
magnoliaeflorus.—Ridl. Fl. Mal. Penins. 1: 25.

* I quite agree with Merrill's remarks in which he advocates the abolition of the name *Griffithia* for this genus, on account of the earlier use of the same name for certain Rubiaceae plants now referred to *Randia*. In such cases there is always the possibility of the earlier named group being again raised to generic rank, which would entail the renaming of the second group.

6. **Enicosanthum** Becc. in Nuov. Giorn. Bot. Ital. 3 : 183, t. 5, ff. 14-18.—1 sp., *E. paradoxum*, Borneo.
7. **Malmea** R. E. Fries in Arkiv. Bot. Stockh. 5. n. 4 : 3 (1906).—1 sp., *M. obovata*, Bahia, Brazil.
8. **Oxandra** A. Rich. in Sagra, Fl. Cubana, 2 : 45, t. 8 (1845).—1 sp., *O. laurifolia*, Cuba.
9. **Porcelia** Ruiz & Pav.—1 sp., *P. dependens*, Peru.
10. **Sapranthus** Seem. Journ. Bot. 4 : 369, t. 54 (1886).—3 spp., Cent. Amer.; type sp. *S. nicaraguensis*.
11. **Cyathostemma** Griffith—5 spp.; Malaya; type sp. *C. viridiflorum*, Mal. Penins.—King, Ann. Bot. Gard. Calcutta, 4 : 11.
12. **Uvaria** Linn. (incl. *Marentheria* Noronha)—110 spp.; S. China to N. E. Austral., New Caled., Fiji, Solomon Isl., Trop. & S. Afr., Madag.; type sp. *U. zeylanica*, Ceylon.—King, Ann. Bot. Gard. Calcutta, 4 : 14. Engl. Monogr. Afr. Anonac. 7.
13. **Anomianthus** Zoll.—1 sp., *A. heterocarpus*, Siam to Java.
14. **Asteranthe** Engl. & Diels Monogr. Afr. Anonac. 30, t. 8, B. (1901), (incl. *Asteranthopsis*, O. Kuntze).—1 sp. *A. asterias*, Mombasa, E. Afr.
15. **Cardiopetalum** Schlechtd. in Linnaea 9 : 328 1834; (*Stormia* S. Moore, 1895).—1 sp. *C. calophyllum*, Bras.—See R. E. Fries in Svenska Vet. Akad. Handl. 34 : n. 5, 38 (1900).
16. **Ellipeia** Hk. f. & Thoms.—14 spp., Malaya; type sp. *E. cuneifolia*, Mal. Penins.—King, Ann. Bot. Gard. Calcutta, 4 : 32.
17. **Cleistopholis** Pierre ex Engl. in Engl. & Prantl. Nat. Pflanzenf. Nachtr. 160 (1897).—6 spp., Trop. Afr.; type sp. *C. patens*, Sierra Leone to S. Nigeria.—Engl. Monogr. Afr. Anonac. 33, partly. Sprague & Hutch. Kew Bull. 1916 : 150.
18. **Duguetia** St. Hil.—20 spp., Cent. & Trop. S. Amer.; type sp. *D. lanceolata*, Bras. (*Aberemoa* Aubl. is an older name for this genus but *Duguetia* is included in the list of *nomina conservanda* of Vienna Congress 1905).
19. **Uvariella** Ridl. Fl. Mal. Penins. 1 : 35 (1922).—1 sp., *U. leptopoda*, Mal. Penins.
20. **Guatteria** Ruiz & Pav. (*); (incl. *Cananga* Aubl.); 80 spp., Cent. & Trop. S. Amer., W. Ind.; type sp. *G. glauca*, Peru. This genus needs revision.
21. **Ephedranthus** S. Moore, Trans. Linn. Soc. ser. 2. 4 : 296, t. 21 (1895).—1 sp. *E. parviflorus*, Brazil.
22. **Kingstonia** Hk. f. & Thoms. Fl. Brit. Ind. 1 : 93 (1872).—1 sp. *K. nervosa*, Mal. Penins.
23. **Pachypodanthium** Engl. & Diels, Notizbl. Bot. Gart. Berl. 3 : 55 (1900).—2 spp., Trop. Afr.; type sp. *P. Staudtii*,

* Although *Cananga*, Aubl. (1775) antedates *Guatteria*, Ruiz. & Pav. (1794) I can see no useful purpose in the renaming of about 80 species by restoring the name *Cananga*, especially as there is already a generally recognised genus *Canangium* Baill. *Guatteria* is included in the list of *nomina conservanda* of the International Code.

- Sierra Leone to Cameroons. *P. confine*, Cameroons.—Engl. Monogr. Afr. Anonac. 32.
24. *Anonidium* Engl. & Diels, Notizbl. Bot. Gart. Berl. 3 : 56 (1900).—2 spp.; type sp. *A. Mannii*, S. Niger., Cameroons. *A. Laurentii*, Congo.—Engl. Monogr. Afr. Anonac. 36.
25. *Fusaea* Safford in Contrib. U.S. Nat. Herb. 18 : 64, f. 73-4 (1914).—1 sp., *F. longifolia*, French Guiana.
26. *Geanthemum* Safford in Contrib. U.S. Nat. Herb. 18 : 66, t. 41(1914).—2 spp.; type sp. *G. rhizanthum*, Rio Janeiro, Bras.; *G. cadavericum*, Brazil.
27. *Tetrapetalum* Miq. in Ann. Mus. Bot. Lugd. Bat. 2 : 1 (1865-6).—1 sp., *T. volubile*, Borneo.

Tribe II.—MILIUSEAE.

28. *Heteropetalum* Benth.—1 sp., *H. brasiliense*, N.E. Brazil, Guiana.
29. *Marsypopetalum* Scheff. in Tijdschr. Nederl. Ind. 31 : 342 (1870).—1 sp., *M. ceratosanthes*, Java.
30. *Phaeanthus* Hk. f. & Thoms.—8 spp., Lower Burma and Andamans to New Guinea; type sp. *P. nutans*, Mal. Penins. to Molucc.—King, Ann. Bot. Gard. Calcutta, 4 : 152.
31. *Trivalvaria* Miq. in Ann. Mus. Bot. Lugd. Bat. 2 : 19 (1865-6).—2 spp., Java; type sp. *T. macrophylla*—Ic. Bogor. 1, 143, t. 48.
32. *Brieya* De Wild. in Fedde, Repert. 13, 383 (1914).—1 sp. *B. fasciculata*, Congo.
33. *Piptostigma* Oliv. in Journ. Linn. Soc. 8 : 158, t. 13, f. 1 (1865).—5 spp., W. Trop. Afr.; type sp. *P. pilosum*, S. Niger.—Engl. Monogr. Afr. Anonac. 54.
34. *Cymbopetalum* Benth.—5-7 spp., S. Mex. to Peru and Bras.; type sp. *C. brasiliense*, Brazil.
35. *Mezzettiosis* Ridl. in Kew Bull. 1912 : 389.—1 sp., *M. Creaghii*, N. Borneo.
36. *Saccopetalum* Benn.—6 spp., India to East Austral.; type sp. *S. Horsfieldii*, Java.
37. *Miliusa* Leschen.—20 spp., Ceyl. to S. China and Java; type sp. *M. indica*, Ceyl. and S. Ind.—King, Ann. Bot. Gard. Calcutta, 4 : 154.

Tribe III.—UNONEAE.

38. *Meiocarpidium* Engl. & Diels in Notizbl. Bot. Gart. Berl. 3 : 54 (1900).—2 spp.: type sp. *M. lepidotum*, Cameroons. *M. ugandense*, Uganda.—Engl. Monogr. Afr. Anonac. 30.
39. *Rauwenhoffia* Scheff. in Ann. Jard. Bot. 2 : 21 (1885).—2 spp., type sp. *R. siamensis*, Siam to Cambodia. *R. warioides*, Aru Isl.
40. *Monocarpia* Miq. Ann. Mus. Bot. Lugd. Bat. 2 : 12 (1865-6).—2 spp., Mal. Archip.; type sp. *M. euneura*, Borneo.

41. *Drepananthus*, *Maing. ex Hook. f.* Fl. Brit. Ind. 1 : 56 (1872).
—4 spp., Malaya, New Guinea; type sp. *D. pruniferus*,
Mal. Penins.—King, Ann. Bot. Gard. Calcutta, 4 : 48.
42. *Desmopsis* *Safford* in Bull. Torr. Bot. Club, 43 : 184 (1916).
—5 spp., Cent. Amer.; type sp. *D. panamensis*, Panama.
43. *Trigyneia* *Schlecht.*—1 sp., *T. oblongifolia*, Brazil.
44. *Desmos* *Lour.* (*Unona*,* of most authors, not of Linn. f. which
= *Xylopia*).—25 spp., S. China, Indo-Malay.; type sp.
D. chinensis, Hong Kong and Hainan, and in India to
Philipp. (cult.).—King, Ann. Bot. Gard. Calcutta 4 : 53
(as sect. of *Unona*).
45. *Meiogyne* *Miq.* Ann. Mus. Bot. Lugd. Bat. 2 : 12 (1865–6).—
1 sp., *M. virgata*, Mal. Penins., Sumatra, Java, Borneo.
46. *Cyathocalyx* *Champ.* 4 spp., Indo-Malay; type sp. *C. zey-*
lanicus, Ceylon.—King, Ann. Bot. Gard. Calcutta 4 : 36.
47. *Oncodostigma* *Diels* in Engl. Bot. Jahrb. 49 : 143, f. 2 (1912).
1 sp. *O. leptoneura*, New Guinea.
48. *Alphonseopsis* *Bak. f.* in Rendle, Cat. Talb. Pl. Niger. 3.
t. 1 (1913).—1 sp., *A. parviflora*, S. Nigeria.
49. *Guamia* *Merrill* in Philipp. Journ. Sci. Bot. 10 : 243 (1915).—
1 sp. *G. marriannae*, Philipp.
50. *Hexalobus* *A. DC.*—6 spp., Trop. Afr.; type sp. *H. senegal-*
ensis, Senegal to Niger & Nile.—Engl. Monogr. Afr.
Anonac. 55.
51. *Papualthia* *Diels* in Engl. Bot. Jahrb. 49 : 138, f. 1 (1912).—
8 spp., New Guin.
52. *Xylopia* *Linn.* (incl. *Unona* Linn. f. and *Waria* Aubl.) 100 spp.
Tropics; type sp. *X. glabra*, W. Ind.
53. *Polyceratocarpus* *Engl. & Diels* in Notizbl. Bot. Gart. Berl.
3 : 56 (1900) (incl. *Dielsina* Kuntze).—1 sp., *P. Scheffleri*,
Tanganyika Territory, Trop. East Afr.—Engl. & Diels,
Monogr. Afr. Anonac. 67, t. 23.
54. *Melodorum* *Dun.* (incl. *Pyramidanthe* and *Mitrella*, *Miq.*).—
55 spp.; East India to S. Yunnan and N.E. Austral.;
type sp. *M. latifolium*, Mal. Penins. & Archip. & Philipp.—
King, Ann. Bot. Gard. Calcutta 4 : 129.
55. *Mitrephora* *Blume* (incl. *Beccariodendron* *Warb.*).—30 spp.,
S. India to S. Yunnan, Indo-China, Malaya to N.E. Austral.;
type sp. *M. obtusa*, Mal. Penins. & Java.—King, Ann.
Bot. Gard. Calcutta 4 : 111.
56. *Uvariastrum* *Engl.* Monogr. Afr. Anonac. 31. t. 10, f. b (1901).
—4 spp., West Trop. Afr.; type sp. *U. Pierreanum*, Gaboon.
57. *Asimina* *Adans.*—11 spp., N. Amer., West Ind.; type sp.
A. triloba, Gt. Lake Region to Texas.—Brit. & Br. Fl. N.
Un. St. & Canad. ed. 2, 2 : 83. Small. Fl. S.E. Un. St. ed. 2 :
447.

* See Safford, "*Desmos* the proper generic name for the so-called Unonas of the Old World," Bull. Torr. Club 39 : 501–508 (1912); also Merrill Philipp. Journ. Sci. Bot. 10 : 234 (1915).

58. *Pseudanona* Safford in Journ. Wash. Acad. Sci. 3: 17 (1913).—2 (or 3) spp., Mauritius; type sp. *P. amplexicaulis*.
59. *Monanthotaxis* Baill. in Bull. Soc. Linn. Par. 2: 878 (1890).—2 spp., Congo; type sp. *M. congensis*.—Engl. & Diels Monogr. Afr. Anonac. 53.
60. *Haplostichanthus* F. Muell. in Viet. Nat. 7: 180 (1891).—1 sp., *H. Johnsonii*, Mt. Bartle Frere, N. Austral.
61. *Artabotrys* R. Br. (incl. *Ropalopetalum* Griff. and *Parabotrys* C. Muell.).—50 spp., Old World Tropics and Subtropics; type sp. *A. odoratissimum*, widely cult. S. India to Formosa.—King, Ann. Bot. Gard. Calcutta 4: 38. Engl. Monogr. Afr. Anonac. 70.
62. *Unonopsis* R. E. Fries in K. Sv. Vet. Akad. Handl. 34: pt. 5, 26, t. 4, ff. 3–8 (1900).—12 spp., West. Ind., Trop. S. Amer.; type sp. *U. angustifolia*, Brazil.
63. *Rolliniopsis* Safford in Journ. Wash. Acad. Sci. 6: 197 (1916).—4 spp., Brazil; type *R. discreta*, Eastern Brazil.
64. *Schefferomitra* Diels in Engl. Bot. Jahrb. 49: 152, f. 4 (1912).—1 sp., *S. subaequalis* New Guin.
65. *Oreomitra* Diels in Engl. Bot. Jahrb. 49: 151 f. 3 (1912).—1 sp., *O. bullata*, New Guinea.
66. *Polyalthia* Blume (incl. *Monoon* Miq.).—about 90 spp., Old World Tropics; type *P. subcordata*, Java.
67. *Popowia* Endl. (incl. *Cleistochlamys* Oliv. and *Clathrospermum* Planch.).—55 spp., Old World Tropics; type sp. *P. piscarpa*, Java.—Engl. Monogr. Afr. Anonac. 43.
68. *Stenanthera* Engl. & Diels, Notizbl. Bot. Gart. Berl. 3: 57 (1900).—7 spp., Trop. W. Afr.; type sp. *S. hamata*, Sierra Leone to Ivory Coast.—Engl. Monogr. Afr. Anonac. 67.
69. *Oxymitra* Hk. f. & Thoms.—35 spp., Indo-Mal. to Solomon Isl., and Trop. West Afr.; type sp. *O. cuneiformis*, Java.
70. *Goniiothalamus* Blume (incl. *Atrutegia* Bedd.).—50 spp., S. and E. India, Malaya, New Guin.; type sp. *G. macrophyllus*, Java.—King in Ann. Bot. Gard. Calcutta 4: 86.
71. *Richella* A. Gray.—2 spp., Fiji; type sp. *R. monosperma*.
72. *Mezzettia* Becc. Nuov. Giorn. Bot. Ital. 3: 187 (1871) (incl. *Lonchomera* Hk. f. & Thoms, 1873).—7 spp. Mal. Penins. Borneo; type sp. *M. umbellata*, Borneo.
73. *Anaxagorea* St. Hil. (incl. *Rhopalocarpus* Teijsm.).—10 spp. Indo-Malaya, Cent. and S.E. Amer.; type sp. *A. javanica*, Java.—King, Ann. Bot. Gard. Calcutta 4: 84.
74. *Bocagea* S. Hil.—4 spp., Trop. S. Amer.; type sp. *B. multiflora*, Amazons.
75. *Hornschuchia* Nees (*Mosenodeandron* R. E. Fries).—1 sp., *H. Bryotrophe*, Brazil.—See Hallier in Beihefte Bot. Centralb. 13: 361 (1903).
76. *Alphonsea* Hk. f. & Thoms.—20 spp., Indo-Malaya; type sp. *A. lutea* Hk. f. & Thoms., Eastern India.—King, Ann. Bot. Gard. Calcutta 4: 161.

77. **Canangium** *Baill.* Hist. Pl. 1: 213 (1868) (incl. *Cananga* Rumph. ex. Hk. f. & Thoms. (1855) not of Aubl. (1775), and *Fitzgeraldia* F. Muell.).—4 spp. Indo-Malaya; type sp. *C. odoratum*, Indo-Mal., often cult.—King, Ann. Bot. Gard. Calcutta 4: 49.
78. **Platymitra** *Boerl.* Cat. Pl. Phanerog. Hort. Bot. Bog. 1: 33 (1899).—2 spp.; type sp. *P. macrocarpa*, Java, Sumatra. *P. siamensis*, Siam.
79. **Orophea** *Blume*.—45 spp., Indo-Malaya, New Guinea; type sp. *O. zeylanica*, Ceylon, Malabar.—King, Ann. Bot. Gard. Calcutta 4: 101.
80. **Disepalum** *Hk. f.*—4 spp., Malaya; type *D. longipes*, Mal. Penins.
81. **Tetrastemma** *Diels* in Engl. Bot. Jahrb. 39: 475, f. 1 (1907).—1 sp., *T. dioicum*, Cameroons.
82. **Uvariopsis** *Engl.* Notizbl. Bot. Gart. Berl. 2: 298 (1889).—2 spp., W. Afr.; type sp. *U. Zenkeri*, Cameroons.—Engl. & Diels, Monogr. Afr. Anonac. 38: t. 15A.
83. **Tridimeris** *Baill.* Adans. 9: 219 (1869).—1 sp., *T. Hahniana*, Mexico.
84. **Dasymachalon** *Dalla Torre & Harms*, Siphonog. 174 (1901).—8 spp., Indo-Malaya; type sp. *D. Blumei* Finet & Gagnep., Indo-Malaya.—See Merrill in Philipp. Journ. Sci. 10: 235 (1915).
85. **Petalolophus** *K. Schum. & Lauterb.* Nachtr. H. Deutsch Sudsee, 265 (1905).—1 sp. *P. megalophus*, New Guinea.
86. **Dennettia** *Bak. f.* in Rendl. Cat. Talb. Pl. Nig. 5, f. 2 (1913).—1 sp., *D. tripetala*, S. Nigeria.
87. **Thonnera** *De Wild.* Ann. Mus. Cong. ser. 5, 3: 36, t. 15 (1909).—1 sp., *T. congolana*, Belgian Congo.
88. **Enantia** *Oliv.* in Journ. Linn. Soc. Bot. 9: 174 (1867).—3 spp., Trop. Afr.; type sp. *E. chlorantha*, S. Nigeria, Cameroons.—Engl. & Diels, Monogr. Afr. Anonac. 69.
89. **Eburopetalum** *Becc.* Nuov. Giorn. Bot. Ital. 3: 181 (1871).—1 sp., *E. borneense*, Borneo.
90. **Ararocarpus** *Scheffl.* Ann. Buitenz. Bot. Gart. 2: 10 (1885).—1 sp. *A. velutinus*, Java.
91. **Anona** *Linn.**—65 spp. Tropics.; type sp. *A. muricata* Linn., widely cult.;—W. E. Safford, Classif. of the genus *Anona* with descriptions of new and imperfectly known species, in Contrib. Un. St. Nat. Herb. 18: 1-68, tt. 1-37 (1914).
92. **Raimondia** *Safford*, Contrib. Un. St. Nat. Herb. 16: 217, pl. 52-3 (1913).—2 spp., S Amer.; type sp. *R. monoica*, Colombia.
93. **Rollinia** *St. Hil.*—35 spp., Cent. and Trop. S. America; type sp. *R. longifolia*, Brazil.

* According to Safford (Journ. Wash. Acad. Sci. 1: 118-120, 1911), this name should be spelled *Annona*, but see also Sprague's note in Journ. Bot. 59: 158 (1921).

Subfamily II.—**MONODOROIDEAE.**

94. *Isolona* Engl. in Engl. & Prantl. Naturl. Pflanzenf. Nachtr. 3, 2: 161 (1897).—10 spp., Trop. Afr.; Madag.; type sp. *I. madagascariensis*, Madag.—Engl. & Diels, Monogr. Afr. Anonac. 82.
95. *Monodora* Dun.—14 spp., Trop. Afr., Madag.; type sp. *M. Myristica*, Sierra Leone to Uganda and Angola (cult. West Ind.).—Engl. & Diels, Monogr. Afr. Anonac. 84.

XXII.—THE CITRUS INDUSTRY IN FIJI.

The following paper on the Citrus Industry in Fiji and the possibilities of its extension is a welcome contribution to the series of papers that have appeared in the Kew Bulletin, from time to time, on the various agricultural crops that have been tried as commercial ventures in these islands. The paper has been written by Mr. C. H. Wright, Government Agricultural Chemist, and sometime Acting Superintendent of Agriculture, Fiji, and has been communicated by the Crown Agents for the Colonies.

The orange is not a native of Fiji; it was introduced into the Colony, according to the "Narrative of the United States Exploring Expedition," Vol. III, p. 335, by Mr. Vanderford in 1823 from Tahiti, where the orange had been introduced from Rio de Janeiro as seed by Captain Cook. The mandarin (a variety of the orange) was a much later introduction into Fiji. This fruit is not mentioned in "A Year in Fiji", 1881, by John Horne, who was in the Colony during the years 1878–9; and the omission is significant, since he devotes a whole chapter to the fruits of Fiji. Enquiries made as to the introduction of the mandarin failed to elicit the country of origin; but all the facts collected pointed to the conclusion that this fruit was introduced into the region of the lower Rewa River in the very early eighties; and an old resident in Fiji remembers first seeing mandarins at Nukumoto (then owned by Hennings Brothers) about 1883.

Orange trees are now found all over Fiji, but these, as well as mandarin trees, are very abundant on the lower Rewa River. They have grown from seed, being mostly self sown; they are generally found in or near Fijian villages, where they are not systematically cultivated; nor do they receive any special care or attention, but are growing in an almost wild state. Yet these citrus trees bear large crops of oranges of very good quality, most of which are of medium size, have a thin skin and contain very few pips; and abundant crops of mandarins, which are above the average size, have a thin loose skin and are of an excellent flavour. These trees do not appear to be affected by any fungoid diseases; they are attacked to a limited extent by mealy bugs

and scale insects, but the worst insect pest to which they are liable is the fruit-fly referred to later. All these facts show that the soil and climate conditions in Fiji are eminently suited for the growth of oranges and mandarins; and give some faint idea of what could be done if these fruits were propagated by budding and grown in orchards with proper cultivation.

Sir Henry S. Berkeley, formerly Chief Justice of Fiji, in a paper entitled "Lime and Orange Cultivation as an Industry", read before the Agricultural and Industrial Association of Fiji in June 1888, advocated the cultivation of limes and oranges in Fiji with a view to their export to New Zealand and Australia. Since that paper was written Australia has developed an orange industry; but now Fiji has direct steamer communication with Canada.

For some time the export of citrus fruits to New Zealand was not possible owing to the certificates required by that Government. Regulation 3 (b) of the Regulations made on 20th February 1908 under the provisions of the Orchard and Garden Pests Act 1903 provided that fruit other than grapes imported into New Zealand must be accompanied by a certificate signed by the shipper certifying that "no species of the fruit-fly is known to exist in or within one mile of the orchard where such fruit was grown," and also by a similar certificate signed by an officer of the Department of Agriculture certifying that "no species of fruit-fly is known to exist in or within one mile of the orchard where such fruit is certified by the shipper to have been grown." These certificates could not be given owing to the presence in Fiji of a fruit-fly, *Dacus passiflorae* Frogg., which not only lives on oranges and mandarins, but has also been found on other fruits, including guava, mango, passion-fruit, dawa (*Pometia pinnata* Forst.) and Kavika (*Eugenia malaccensis* L.).

Mr. H. W. Simmonds, F.E.S., at present Acting Government Entomologist, was employed by the Government of Fiji in 1920 on a mission to Tahiti to search for and bring to Fiji parasites of the scale insect (*Aspidiotus destructor* Sign.), which was then a serious pest of coconuts in certain parts of the Colony. In this work Mr. Simmonds was entirely successful, and on his return to Fiji visited Rarotonga and made enquiries as to the methods of exporting fruit from there to New Zealand. The following is an extract from his report on this subject:—

"The worst pest is undoubtedly the fruit-fly, *Dacus rarotongensis*. This insect does not seem to have been present formerly, whilst it has only quite recently spread to Mauke and Mangaia, two other Islands of the group. It is now exceedingly common, living on guava and other wild fruits, and attacking oranges in the season . . .

"The method adopted in Rarotonga so far as export is concerned is to set aside a couple of days for picking about 10 days before the New Zealand steamer is due to sail. The fruit is then stored in sheds until a couple of days before

the boat leaves, when it is repacked, and the attacked fruit, which is easily seen, is discarded. As the fruit is brought to the wharf the fruit inspector selects two or three cases from each load, which are opened, when should he find fly-infected fruit the whole consignment is condemned."

As a result of his enquiries in Rarotonga, Mr. Simmonds unofficially approached the Department of Agriculture in New Zealand to see if something could not be done to enable citrus fruits to be imported there from Fiji. He then suggested that all citrus fruits for export should be stored in fly-proof sheds for 8 to 10 days before shipment and then packed and graded under supervision. This proposal would overcome the difficulty of giving a certificate stating that no fruit-fly occurs within a mile of the orchard where the fruit was grown, and would thus open a new market for citrus fruits grown in Fiji.

The attention of the Government of New Zealand was drawn to the above facts, and as a result that Government in November 1920 made the following suggestions with a view to providing better control of the export of fruit from the Pacific Islands, and the prevention of the shipment of any such fruit affected by fruit-fly or other diseases :—

"(a) The Authorities of the Islands to erect at ports of shipment suitable sheds, having all openings covered with wire gauze."

"(b) All fruit for export to be in the above sheds at least 5 days before being packed."

"(c) No fruit to be exported without going through the said sheds."

"(d) All fruit to be sorted and packed under Government supervision."

"(e) All fruit to be accompanied by a certificate stating that it had been held for 5 days in the Government sheds before being packed, and that in the opinion of the Inspector it was free from fruit-fly and other diseases."

It was considered that the above proposals, if given effect to, would obviate the condemnation in New Zealand of fruit infected with fruit-fly, and would be the means of saving a large amount of money lost in connection with freight on fruit that is condemned and would also provide greater security against the introduction of fruit-fly than the existing conditions afforded.

A trial shipment of 344 cases of mandarins and 12 cases of oranges inspected and packed in accordance with the above suggestions was made by s.s. "Tofua" in May 1921. The mandarins on inspection in New Zealand were found to be free from fruit-fly, and were sold at satisfactory prices. The oranges, however, were found to be infected with maggots and were therefore condemned. These oranges were kept in the same fly-proof chamber as the mandarins, and it therefore appears that oranges are more liable to be attacked by fruit-fly than mandarins, probably owing to the

larger quantity of acrid oil contained in the skins of the latter fruit. Two subsequent shipments of mandarins during the same year were condemned owing to the presence of the fruit-fly in them; but it is worthy of note that both these left Fiji late in the season, when citrus fruits are apparently more liable to be attacked by this insect.

In March 1922 another trial shipment, consisting of 10 cases of oranges and 15 cases of mandarins was made by the Department of Agriculture. In this case special precautions were taken to select only sound mature fruit. It was picked at Wainibokasi on 10th March; brought into Suva on the 13th; stacked in a fly-proof chamber on the 14th where it remained for 7 days, and after packing was shipped by the s.s. "Navua" which left Suva on the 22nd. This fruit arrived in Auckland "in excellent condition with the exception of a few mandarins in one case" (extract from broker's report), and was sold at very satisfactory prices. The proceeds of sale were as follows:—

		£	s.	d.
<i>Oranges</i>	-	8	3	0
<i>Mandarins</i>	-	19	6	0
Total		£27	9	0

The expenses of this trial shipment were - 15 0 11

It will thus be seen that the credit balance was £12 8s. 1d.; this is very satisfactory, but too much importance should not be attached to the actual amount as the prices realised for some of this fruit, particularly the mandarins, were exceptionally high. The real value of this trial shipment is the fact that it was a demonstration that by carefully selecting the fruit and storing it in a fly-proof chamber for 7 days and then packing, citrus fruits could be landed in New Zealand free from the fruit-fly.

Encouraged by the success of this experiment several other shipments of citrus fruits were made to New Zealand by members of the public; and 70 cases of mandarins previously stored and packed under the conditions described above were sent to Vancouver. Many of the mandarins in this consignment arrived in Canada in a green state; this is rather surprising when it is considered that this fruit was 7 days in a fly-proof chamber and then 16 days on board ship. Unfortunately the green mandarins were not appreciated in Canada, apparently because the public there are accustomed to the tangerines imported from Japan, and the green mandarins from Fiji were regarded by them as unripe. These facts should be taken into consideration in any efforts made to extend the export of citrus fruits to Canada, as they will probably raise the same difficulties that have already been encountered in trying to place West Indian limes on the English market as a substitute for lemons.

XXIII.—NOTES ON UPPER GUINEA FLACOURTIACEAE.

T. F. CHIPP.

Dasylepis Oliv. As originally suggested by Oliver in the Journ. Linn. Soc. ix. p. 172, the genus *Pyramidocarpus* showed marked affinity with the Flacourtiaceae. The addition of more recent material from Upper Guinea makes it clear that *P. Blackii* Oliv., hitherto the only species described, must be regarded as a species of *Dasylepis*. The description of *Pyramidocarpus* in Die Nat. Pflanzenfamilien iii. 6. p. 16, is incorrect as regards the absence of scales of the perianth, and the style. Mann's specimen from the River Muni, on which Oliver based the genus *Pyramidocarpus*, shows the scales adnate to the inner perianth segments, and a short simple style with a trifid stigma as described by Oliver. The genus *Dasylepis*, therefore, must be regarded as comprising the following five species :—

D. racemosa Oliv. Cameroons.

D. integra Warb. Usambara.

D. leptophylla Gilg. Usambara.

***D. Blackii* (Oliv.) Chipp. comb. nov.**

D. brevipedicellata Chipp.

***Dasylepis brevipedicellata* Chipp**; species laminis margine toto denticulato-serratis, pedicellis brevibus, floribus confertis ovariiis glabris, distincta.

Arbor (?) ramulis glabris. *Folia* glabra, coriacea, oblonga basi subcuneata, apice rotundata apiculata vel obtusa acuminata, margine distanter denticulato-serrata, 15–18 cm. longa, 6–7 cm. lata; nervi laterales subtus prominentes, utrinsecus 5–7; petioli circiter 1 cm. longi, infra laminas articulati. *Flores* in racemos spiciformes conferti; racemi apice ramorum in foliorum axillis collecti; rachis glabra, usque ad 5 cm. longa; pedicelli 2 mm. longi. *Perianthia* ciliolata, circiter 9, exteriora 7 mm. longa, 5 mm. lata, interiora 7 mm. longa, 3 mm. lata; squamae dense pilosae dimidiaie parti aequantes perianthio interiori adnatae. *Stamina* numerosa, filamenta 5 mm. longa; thecae 3 mm. longae. *Ovarium* glabrum; stylus apice 2–3–4-divisus.

TROPICAL AFRICA. Gold Coast; Ashanti, Mim, *Thompson* 52.

Scottellia Oliv. From description and examination of foliage *S. macropus* Gilg. & Dinkl. from Liberia appears to be the same as *S. leonensis* Oliv. and should be regarded as a synonym.

***Scottellia Chevalieri* Chipp**; affinis *S. kamerunensis* Gilg., sed laminis margine toto serratis subtus dense glandulosis, petiolis longioribus, sepalis non valde nervosis, squamis basi petalorum ad setas fere reductis, differt.

Arbor ramulis junioribus teretibus glabris. *Folia* subcoriacea, ovato-oblonga, basi cuneata vel subrotundata, apice rotundata late acuminata, margine toto inaequaliter serrata, subtus dense glandulosa, 8–11 cm. longa, 4.5–6.5 cm. lata; nervi laterales

utrinsecus 6-9; petioli 1-1.5 cm. longi. *Flores* in racemos spiciformes multifloros valde densifloros dispositi, pedicellis tenuibus; racemi in apice ramorum vel in foliorum axillis collecti; bracteae ovatae, mox deciduae, 1-2 mm. longae; bracteolae minutissimae, dense pilosae; rachis minutissime pilosa. *Sepala* rotundata, ciliolata, 2 mm. longa. *Petala* (matura non visa) apice parce pilosa, squamis minutis basi petalorum ad setas fere reductis. *Stamina* 5. *Ovarium* apice in stylum brevem crassum in ramos 3 divisum.

TROPICAL AFRICA. Ivory Coast; Vallée de l'Agineby, Kapiécrou, *Chevalier* 16182, 16182 bis.

Camptostylus Gilg. As suggested by Gilg (Engl. Bot. Jahrb. 40: 451) Mann's specimen No. 1196 from the Cameroons described by Oliver (Flor. Trop. Afr. 1: 118) as *Oncoba ovalis* must be referred to this genus and becomes *Camptostylus ovalis* Chipp, comb. nov. *C. caudatus* Gilg. from the same locality must be regarded as a synonym.

Caloncoba Gilg.

C. ficifolia Chipp, comb. nov. *Oncoba ficifolia* Gilg.

Flacourtia Commers.

In view of the considerable difficulty experienced in defining the species described, it appears better to regard the Upper Guinea material generally as belonging to *F. flavescens* Wild., and a second species *F. Vogelii* Hook. f. comprising the Nigerian material with markedly fine parallel veins in the leaves. *F. Ramontchi* L'Herit., was based on a Madagascar plant.

XXIV.—PITA AND SILK GRASS.

C. H. WRIGHT.

A considerable amount of public attention has recently been directed to the fibre-yielding plants of Central and South America, and from enquiries received it has been evident that a good deal of misunderstanding prevails in respect of the vernacular name "Pita," and its compounds Pita de Colombia, Pita del Opon and Pita floja. The term Pita, which is found in early botanical works dealing with that part of the world, is a Spanish word applied generally to fibre-yielding plants of the nature of the *Agave*, and even to the prepared fibre itself. Its local application has been extremely wide, and has embraced *Ananas sativus* Schult, ⁽¹⁾⁽³⁾ and many fibre-yielding members of the family *Bromeliaceae*, and also many species of *Agave*.⁽²⁾⁽³⁾⁽⁴⁾ In some

⁽¹⁾ Mart. Fl. Bras III. iii. 290 (1892).

⁽²⁾ Corres, Flora de Colombia, p. 256 (1897).

⁽³⁾ Kew Bulletin, Add. Ser. XI., General Index.

⁽⁴⁾ J. R. Drummond and D. Prain. The Agricultural Ledger, Calcutta,

more restricted areas, such as British Honduras, the name "Silk Grass" appears to be more commonly used than "Pita," but this apparently also has an equally wide application, and is used more in respect to the fibre than to any particular kind of plant which produces it.

Mr. M. T. Dawe⁽¹⁾ has recently raised the question as to the identification of the Colombian plants, from which Pita fibre is obtained. The material supplied to Kew was without flowers and consequently could not be definitely determined, but so far as could be ascertained these specimens seemed to support the view that the Colombian Pita plant is *Ananas macrodontes* E. Morr.

Further specimens of a plant known as Pita have been received through the courtesy of Mr. C. E. Dixon, who forwarded to Kew a few flowers and one bracteole collected from the Pita groves in the Chiriguana district of Colombia. These show that the plant is a species of *Bromelia* and is identical with *Aechmea Magdalenae* André (*Chevalliera Magdalenae* André), of which only leaves and young fruit were previously known, and of which a specimen at Kew collected at Balao, Colombia, by Eggers, in January, 1892, quite agrees with Dawe's photograph of the Pita fruit, and is accompanied by leaves 10 ft. long and 4 inches wide. Mez in his monograph of the *Bromeliaceae*, p. 284, notes this species as "*Pita Ecuadorensibus* (ex Eggers)."

André admits in a note in his *Bromeliaceae Andreanae* that his specimens, which have not been found at Kew, may have been mixed so far as leaves and flowers are concerned, and the leaves he figures on his plate 3 do not seem to agree with those received from Eggers in having more numerous and less robust prickles. Mr. Dawe (*Tropical Life*, 1920, p. 182) describes the flowers as blue, while Mr. Dixon in his letter describes them as light yellow. In other respects Mr. Dawe's description agrees with that of *Aechmea Magdalenae*, which must now be called *Bromelia Magdalenae*, the flowers of which are described below.

***Bromelia Magdalenae* C. H. Wright.** *Aechmea Magdalenae* André, *Bromel. Andreanae*, p. 7; Baker, *Handb. Bromel.*, p. 65 Mez, *Monogr. Bromel.*, p. 284. *Chevalliera Magdalenae* André, *Enum. Bromel.*, p. 3, and *Bromel. Andreanae*, p. 7, t. 3 (excl. leaf?). *Sepala* triangularia, longe acuminata, asymmetrica, arcute carinata, induplicata, sublignosa alis coriaceis, dense lepidota, 4 cm. longa, 1.2 cm. lata. *Petala* basi leviter connata, oblonga, acuminata, eligulata, pallide lutea (fide Dixon). *Stamina* prope basin petalorum inserta; filamenta 1.3 cm. longa, complanata; antherae prope basin dorsifixae, 1.1 cm. longae, acutae, sagittatae; pollinis granula subglobosa, eporosa, membrana crassa instructa. *Ovarium* breviter triangulare, stylus staminibus aequilongus; rami 6 mm. longi, membranaceo-alati.

(¹) *Tropical Life*, Dec. 1920, Jan. 1921, May 1922.

XXV.—MISCELLANEOUS NOTES.

MR. G. DEAR.—In December last Mr. G. Dear retired under the age limit, after a service of upwards of thirty-eight years at Kew. Mr. Dear entered Kew on July 7th, 1884, and after serving successively as a gardener and as Seed Collector, he was appointed Storekeeper on the 1st May, 1893. The duties of Storekeeper occupied only a portion of Mr. Dear's time, the remainder being spent in clerical work in the Curator's office. The conscientious manner in which Mr. Dear discharged his duties as Storekeeper is known to many generations of Kew men, while his work in the Curator's office was invariably marked by accuracy and good judgment.

Fruit Cultivation in Trinidad and Tobago.*—One of the chief difficulties experienced in the tropics is the supply of fresh fruit and vegetables. Although many tropical stations have now been established for several decades it is astonishing to find that the cultivation, improvement and introduction of fruits has received such scant attention that in many tropical Colonies it is difficult to obtain even bananas and pawpaws at certain times of the year. That market gardening in the tropics is hardly a sufficiently important commercial industry to attract the Europeans is partly the reason of its neglect, but the increasing demand for fruit in the evergrowing centres of population makes it almost imperative for local authorities to begin to take an active interest in its supply. The attempt of the Trinidad Agricultural Society to arouse the interest of the small holder has resulted in the publication of a treatise on the cultivation of the principal fruits suitable to the country, the general treatment, diseases and working costs being given with each crop. More than that, however, the Preface states the practical steps being taken to interest individuals in the venture. This consists not only in selling good stock at a low price but in assuring a market to the planter.

"It is felt that the immediate market can be obtained by developing a local trade on similar lines to that which has been developed during the last five years in 'ground provisions' (yams, sweet potatoes, tannias, corn, peas, &c.). Prior to 1917 there was little inducement for anyone to grow ground provisions, unless he was prepared to sell in the local markets, which usually meant sending someone personally to dispose of the produce. The opening of the Government Ground Provisions Dépôt in Port-of-Spain, and subsequently one in Tobago, has changed that, and produce can be consigned by rail or steamer and full cash value received by return. The business has grown from one of £1,615 receipts in the first twelve months to over £12,000 in 1921. The Department of Agriculture is opening early in

* Fruit Cultivation in Trinidad and Tobago. The Agricultural Society of Trinidad, Nov. 1922, pp. 91. 17 plates and figs. 1s.

1923 a Fruit Shop in Frederick Street, Port-of-Spain, to be run on similar lines to its Ground Provisions Depôt, and it is confidently hoped that this will enable those who have only a few trees, to dispose of any good produce to advantage. This will encourage planting, and lead to there being greater supplies of fruit than are wanted for local consumption.

"The next step should be supplying ships calling at Trinidad, and also exporting to Barbados and Bermuda where a former Fruit Committee of the Society ascertained there was a demand for our fruit.

"With a still larger production, and the experience gained meanwhile, we should be able to place our fruit successfully on more distant markets, *e.g.*, the United Kingdom and Canada, which with our limited supply is practically impossible at present excepting in casual consignments. There need not be long intervals between the first steps—the local trade, supplying ships, and exporting to Barbados and Bermuda, as when once a start is made on definite lines it is probable that the existing supplies will prove greater than is at present realised."

The example of Trinidad in this direction can be commended to those tropical Colonies where a lack of fresh fruit and vegetables is constituting a serious menace to the health of the town populations.

Menzies' Journal of Vancouver's Voyage.*—The name of Archibald Menzies, a Scottish gardener who forsook gardening to study botany and medicine, and during the latter years of the eighteenth century became an eminent explorer and traveller, is well known to horticulturists by reason of his introductions of trees and other hardy plants from Western North America, a region at that time new to European travellers. Born in 1754 at Stix near Aberfeldy in Perthshire, he was educated at Weem Parish School and began his gardening career in the famous gardens at Castle Menzies. He afterwards entered the Royal Botanic Gardens, Edinburgh, as a student, where he commenced working for a medical degree. In 1782 he was acting as assistant surgeon in the Royal Navy and saw active service in Rodney's victory over the Comte de Grasse. During the next few years he took part in several long voyages of exploration and in 1790 the British Government appointed him as naturalist to accompany Captain Vancouver in the "Discovery" on a voyage round the world. The voyage extended from 1790 to 1795, and Menzies' duties were "to investigate the whole of the natural history of the countries visited, paying attention to the nature of the soil, and in view of the prospect of sending out settlers from England, whether grains, fruits, etc., cultivated in Europe are likely to thrive. All trees, shrubs, plants, grasses, ferns,

* Menzies' Journal of Vancouver's Voyage, April to October 1792. Edited by C. F. Newcombe, M.D. Publication of the Provincial Library and Archives Department of British Columbia, \$5.00.

and mosses were to be enumerated by their scientific names as well as those used in the language of the natives. He was to dry specimens of all that were worthy of being brought home and all that could be procured, either living plants or seeds, so that their names and qualities could be ascertained at His Majesty's gardens at Kew. Any curious or valuable plants that could not be propagated from seeds were to be dug up and planted in the glass frame provided for the purpose." The present work deals with the portion of Menzies' journal covering the period April to October 1792, whilst the expedition coasted Western North America from latitude $35^{\circ} 25'$ north, off Northern California, to latitude $52^{\circ} 18'$, where the survey for the season ended at Port Menzies in Burke Channel, and it forms Memoir No. V. of the Archives of British Columbia, under the editorship of Dr. C. F. Newcombe. The extracts from the journal chiefly deal with boat journeys conducted amongst the numerous islands, bays and straits for the purpose of surveying the coast-line, and from a botanical point of view they are disappointing. Land journeys appear to have been limited in number and extent, and the collection of plants must have been carried on under great difficulties. Nevertheless there are numerous references to interesting plants being planted in the glazed frame on the quarter deck of Captain Vancouver's ship, and the foundation was laid for the subsequent highly successful exploration of the forest flora of Western North America by David Douglas. The pages contain a great deal of interesting information concerning the physical, ethnological, zoological and general botanical characteristics of the region, although we should have expected to have heard more of the impression created by the wonderful vegetation of what was practically a new country. Nearly 300 forms of plant life were collected, which included flowering plants, ferns, mosses, lichens, and marine algae. Dr. Newcombe has presented his work in an attractive manner, while an introductory biographical note by Mr. J. Forsyth is full of interest.

W. D.

The Destructive Distillation of Wood.*—The destructive distillation of wood is an increasingly important factor in the economic working of forest areas and timber yards, for by this means it is now possible to turn to good account material that was at one time wasted. The demand for methyl alcohol alone suggests that wood distillation will occupy an even more important position in the future than at present, whereas the uses for acetic acid, charcoal, tar, tar oils, resin, turpentine, and other products are constant. Thus the appearance of an exhaustive treatise upon the subject is very gratifying, and particularly so when produced by a man of such wide understanding as Mr. Bunbury.

* H. M. Bunbury. *The Destructive Distillation of Wood*. Benn Brothers, Limited, London, 1923. Price 35s. net.

The work begins with a historical chapter on the development of the wood distillation industry and is followed by chapters on the trees used for the purpose; the chemistry of wood; factors influencing the thermal decomposition of wood; the crude products of distillation; the thermal decomposition reactions; wood distillation on a commercial scale; the factory; wood distillation plant and operations; the production of charcoal and crude pyroligneous acid; the production of dilute calcium acetate solution and wood alcohol; the production of dry calcium acetate, refined wood alcohol, pure methyl alcohol, refined wood turpentine and pine oils; the production of wood tar, wood oils, and wood pitch; the destructive distillation of small wood and wood waste; the production of illuminating and power gas from wood; analytical methods; statistics. It will thus be seen that the work is thoroughly comprehensive, whilst its value is increased by upwards of 100 excellent illustrations of plants, etc., and 115 tables which clearly indicate the results of various experiments. Whilst the book is primarily one for the manufacturing chemist it will also be found of considerable value to foresters and wood-workers, particularly those parts that refer to waste wood, and it is likely that it will become a standard work for forest students. Although published in England there is much in the book that is applicable to other countries, especially to Canada and the United States, as many of the tables deal with North American woods the products of which may easily be compared with allied European species.

W. D.

Dates and Date Cultivation of the Iraq.*—Parts I and II of this work were reviewed in the Bulletin for 1922, pp. 156-158. The present issue, Part III, deals mainly with the varieties of Date Palms of the Shatt Al 'Arab. A descriptive list of 48 varieties of female palms is given and a note is added on the male palms of the region, of which the number reported is insignificant in comparison with those of the female. "The common male palm of the whole Shatt Al 'Arab region is the "Khikri," a rankly growing vigorous palm, easily distinguishable from surrounding females by its greater height, greater girth, larger number of fronds and more numerous and bigger spines." Included in the work are notes on the "Distribution of Date Palms," "Date Varieties and their Classification," lists of the Varieties of Date Palms of the World, covering Morocco, Algeria, Tunisia, Tripoli, Egypt, Sudan, Cyprus, Arabia, Persia, India, United States of America and Australia. The work is well illustrated and contains an extensive bibliography.

J. H. H.

* V. H. W. Dowson. *Dates and Date Cultivation of the Iraq*. Part III. W. Heffer & Sons, Ltd., Cambridge, 1923: pp. 97, price 10s.

Botanists in Germany and Austria.*—The library has received through Dr. Stapf a pamphlet the purpose of which is to give the names of botanists at the numerous scientific institutions in Germany and Austria. In view of the fact that the latest edition of Dörfner's "Botaniker-Adressbuch" was issued in 1909, and is therefore out-of-date, the need of Prof. Janchen's list has been much felt. It supplies first the names of the institutions in Germany, arranged under towns. Separate lists are given for Austria and for German institutions in Czecho Slovakia. These are followed by an index to the institutions arranged under subjects, and finally an index to personal names is provided.

Siamese Plant Names.†—Under the direction of the Chief Conservator of Forests, Siam, a list of the vernacular names of trees, shrubs, etc., with their botanical equivalents has recently been compiled and published. The vernacular names are given in Siamese and roman characters and are arranged under Siamese letters as explained on the contents page. The work is intended for forest officers, timber merchants and students and should prove of much use locally, but without an alphabetical index in roman characters it loses much of its value to workers unacquainted with Siamese.

* Die in Deutschland und Österreich an wissenschaftlichen Anstalten wirkenden Botaniker. Unter Mitwirkung zahlreicher Fachgenossen zusammengestellt von Erwin Janchen. Wien und Leipzig: Druck und Verlag von Carl Gerold's Sohn, 1923. 8vo. Pp. 32.

† Phya Vanpruck Picharn. List of Common Trees, Shrubs, etc., in Siam. Bangkok Times Press, 1923, pp. 278.